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BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

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REPORT OF PINE-BEETLE SURVEYS
on the
MALHEUR NATIONAL FOREST
1931-1938

Forest Insect Laboratory
445 U. S. Courthouse
Portland, Oregon

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REPORT OF PINE-BEETLE SURVEYS
on the
MALHEUR NATIONAL FOREST
1931-1938

Approved by:

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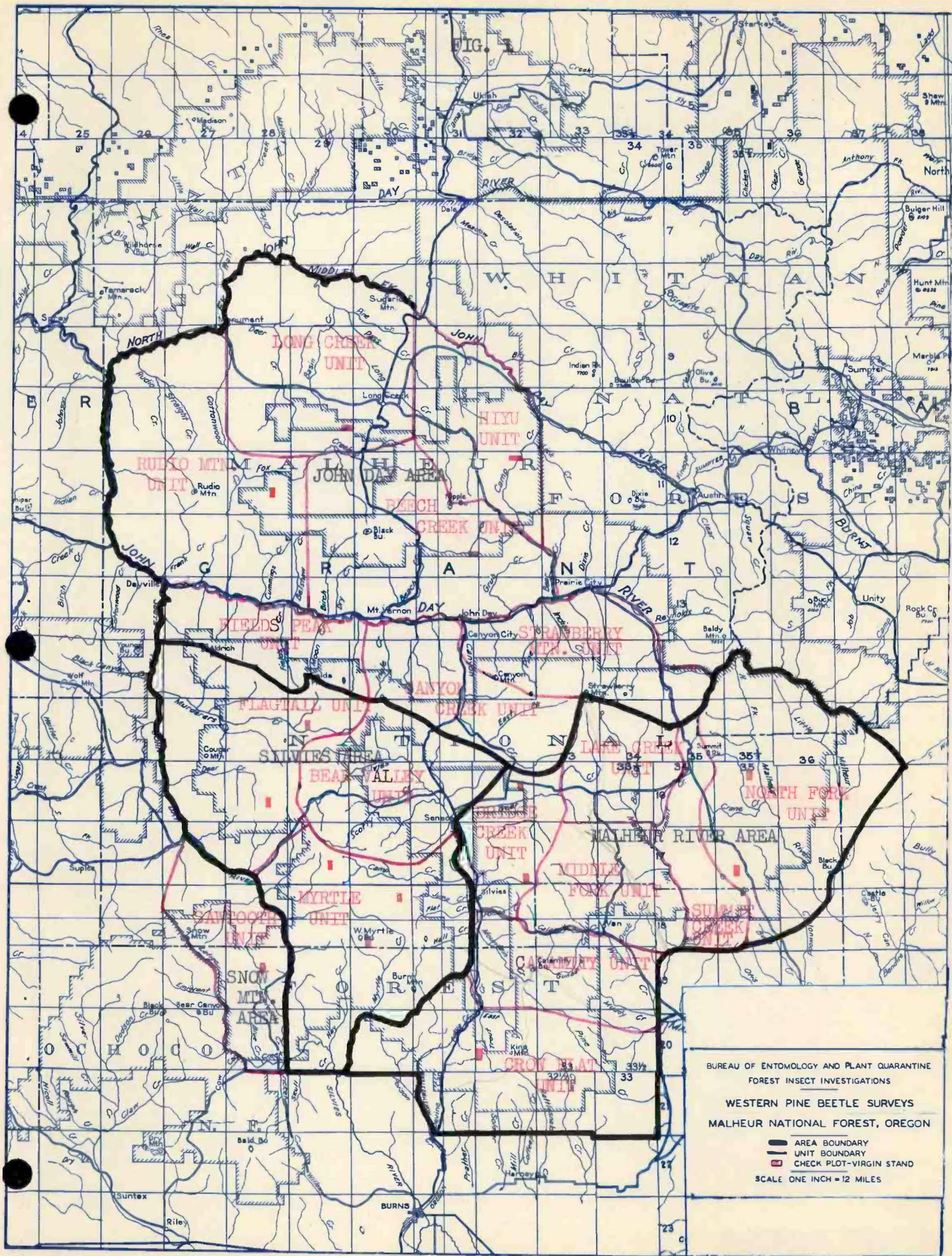
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Introduction.

Sporadic outbreaks of western pine beetle (*Dendroctonus brevicornis* Leo.) in the ponderosa pine stands of the Malheur National Forest have been noted by forest officers from time to time during the past 20 years. Beginning in 1931 annual cruises of permanent check plots were started to supplement the more general observations. These annual pine-beetle surveys have served a number of purposes, principally (1) to determine the trend, intensity, and distribution of infestation by the western pine beetle and other insects destructive to the forest, (2) to determine the need for artificial control work, (3) to familiarize forest personnel and timber owners with existing forest-insect problems, and (4) to determine what trees and areas offered the highest risk of beetle attack and warranted special consideration in cutting programs.

These surveys have been carried out cooperatively by the Forest Service and Bureau of Entomology and Plant Quarantine. The Forest Service either made year-long personnel available or employed field assistants to carry on the intensive field work. The Bureau furnished direct supervision of these crews and made the general estimates of timber losses through extensive reconnaissance methods.

History of Surveys.

In October 1931, four 160-acre check plots were established. These were located on the Flagtail, Myrtle, Sawtooth, and Crow Flat Units. The plot status remained unchanged until 1935, when the size of these plots was increased to 320 acres each, and two new plots were established. On the 1936 survey, five of these plots were recruised and nine additional plots established. A total of 16 plots were cruised during 1937. Of these, 10 were cruised last season and 6 new plots established, making a total of 20 plots that have been set up on the forest. All plots cruised during 1937 were again cruised in 1938. The location of these plots is shown in figure 1.

Survey Methods.

Prior to 1937 crew members either had previous experience or were trained on the ground by the crew supervisor before assuming field duties. In 1937 and 1938 members of the Malheur crew, with those of four other crews, were given two to three weeks of intensive training in survey methods, at a school held at Camp Sisters on the Deschutes National Forest.

Each year a 100 percent cruise of beetle losses on each check plot is made and pertinent data are recorded for each tree killed. During 1935 and 1936 plot cruises were supplemented by an extensive survey of all the ponderosa pine stands on the forest. This was accomplished by using the individual strip system. The strips were five chains wide and often 3 to 10 miles long. Recent losses were mapped as to degree of intensity. In addition, snag counts were made to determine the extent of old beetle losses.

The 1937 survey included a stand structure and volume cruise of the living ponderosa pine stands in order to secure more information as to the relative beetle hazard of various types of trees and stands of varying maturity and thrift.

The 1938 plot work was supplemented by visual estimates of the ponderosa pine losses per section for the entire forest. Loss data obtained from the plot work were used as a measure to gauge the severity of losses on surrounding areas. To make this general loss estimate in 1938, the writer made observations from 14 primary or emergency lookouts, as well as from other points of vantage and many roads on the forest. From these estimates a map has been prepared (Figure 2) showing the degree of intensity and distribution of the 1937 western pine beetle infestation.

Survey Personnel.

Names of the personnel who have assisted in making the annual surveys on the Malheur Forest are presented herewith:

1931—F. P. Keen (leader) and W. J. Buelhorn, Bureau of Entomology, assisted by District Rangers H. E. Elliott and M. O. Tims.

1932—W. J. Buelhorn (leader) Bureau of Entomology, assisted by F. Cory of the Supervisor's office and District Rangers H. E. Elliott and M. O. Tims.

1933—J. M. Whiteside (leader) Bureau of Entomology, assisted by J. C. Iler of the Supervisor's office and District Ranger M. O. Tims.

1934—J. C. Iler (leader) of the Supervisor's office, assisted by District Rangers H. E. Elliott and M. O. Tims.

1935—Field Assistants I. E. Herrala (leader), A. Poust, and J. H. Wood, Forest Service, supervised by W. J. Buelhorn, Bureau of Entomology and Plant Quarantine.

1936—Field Assistants A. Poust (leader), R. Allan, and R. Goiner, supervised by W. J. Buelhorn, Bureau of Entomology and Plant Quarantine.

1927—200 Student Assistants J. F. McKenna, D. W. Moore, J. Ostlund, C. Stephens, and V. I. Carter (crew leader) under the joint supervision of W. J. Buckhorn of this Bureau and A. J. Jaenicke of the Forest Service.

1936—Field Assistants R. F. Goodall (leader), E. A. Bruckett, and J. Ostlund, supervised by W. J. Buckhorn of this Bureau.

Forest Description.

The Malheur National Forest lies on the south and west slopes of the Blue Mountains in Oregon. It occupies a large portion of Grant County and lesser portions of Harney, Baker, and Malheur Counties.

Topography is of rolling to rough terrain. The elevations range from about 3,000 to 7,000 feet, with a few peaks much higher. Approximately 90 percent of the timber stands are of the ponderosa pine type. Douglas, white, and alpine firs, lodgepole pine, western larch, and Engelmann spruce are found on moist northern slopes or at high elevations.

Data from the inventory phase of the Forest Survey^{1/} show approximately 1,018,000 pine timbered acres on the Malheur Forest and adjoining lands, supporting a stand of 8,374,733 M board feet of commercial ponderosa pine as of January 1, 1937.

Area Description.

From an entomological viewpoint, the forest and adjoining lands have been divided into four so-called infestation areas, which in turn have been subdivided into 17 units. The pine timbered acres and volumes for each of these areas are given in table 1. The locations of these areas and units and of the check plots cruised in 1936 are shown on figure 1.

John Day Area.—This area occupies that portion of the forest lying north of the crest of the Strawberry and Aldrich Mountains. Boundaries of the north and west sides are formed by the south, middle and north forks and John Day River proper, which also drain the area. The east boundary is that of the Whitman National Forest.

Silvies Area.—This area includes most of the southwestern portion of the forest. The north boundary is formed by the Aldrich Mountains, and the east and west boundaries by the Silvies River and South Fork of the John Day River which also drain the area. The south is bounded by open sage and grass lands.

^{1/} U.S.D.A. Pacific Northwest Experiment Station Forest Statistics for Grant Co., Oreg., Walter E. Felto, Aug. 5, 1937; for Harney Co., Oreg., F. L. Moravets, May 7, 1936; and for Baker Co., Oreg., W. H. Bolles, May 10, 1937.

Snow Mountain Area.—This area is located in the extreme southwest portion of the forest, lying between the South Fork of the John Day on the east and the Ochoco National Forest on the west. Open grass lands are to the south. Drainage is by the South Fork of the John Day River and Emigrant Creek.

Walheur River Area. This area includes the southeastern portion of the forest. The west boundary is formed by the Silvies River, the north by the Strawberry Range, and the east and south by open grass lands. The larger portion drains south through the Walheur River. A small portion on the west drains into the Silvies River.

Timber Utilization.

Prior to 1929, forest utilization was limited to supplying the wants of local settlers. During this year extensive logging operations were begun in the vicinity of Jensen, Oreg., by the Edward Hines Lumber Company and operating on both private and national forest lands. Most of the private lands were clear cut, then burned over, leaving little or no residual stand. Cutting on the national forest has been regulated on a sustained yield basis; on the early operations on national forest lands approximately 20 percent of the volume was left standing. Later this practice was modified, and the residual stand now being left is approximately 60 percent of the original volume.

History of Pine-beetle Damage and Infestation Trend, 1931-37.

The scarcity of old snags and down logs in 1931, when the first sample plots were established, indicated that insect-caused losses in the ponderosa pine stands of the forest had been negligible prior to the beginning of this decade. A change in this quiescent infestation was brought about by the cumulative effect of drought conditions which began about 1917 and were becoming more critical at this time, resulting in a reduction of tree growth and greatly lowered resistance of the pine stands. This situation created favorable conditions for the development of the western pine beetle. The endemic infestation existing over the forest began building up rapidly, and by 1931 a tremendous epidemic had developed, reaching its greatest intensity in 1932.

Timber stands on the drier sites, especially at the lower elevations in the southwestern portion of the forest, suffered the most severe losses. A loss of 12.34 percent of the stand was recorded during the three-year period 1931-33 on the Sawtooth sample plot Sec. 15. Sec. 17 of the Flagtail Unit showed about half this loss, 6.62 percent of the stand for this period. Crow Flat and Calamity Units suffered similar heavy losses.

The severity of the infestation diminished with increase of elevation where moisture conditions were better, as is shown by Sec. 26, Myrtle Unit, which lost only 1.82 percent of the stand during this same period.

This upward trend of infestation was abruptly halted in the winter of 1932-33 by two periods of extreme subzero temperatures that caused 85.3 percent mortality ^{2/} to the overwintering broods of the western pine beetle. The first period of cold occurred December 11, 1932, when -17° to -34° F. were recorded. The second period occurred February 10, 1933, when from -21° to -54° F. were recorded at Seneca. The infestation then declined rapidly through 1933, reaching a low of .42 percent of stand killed in 1934. An increase took place during 1935, but another cold period that caused some brood mortality occurred in the fall of 1935, and coupled with improved growth conditions, the infestation again subsided to .55 percent of the stand killed in 1936. There was considerable variation in the infestation trend on the various areas and units during 1937, but the average is somewhat above that of 1936, with .57 percent of stand loss in that year. The above described epidemic cycle is shown graphically on Chart 1.

Detailed loss figures for various check plots since they were established are given in table 2. Table 3 is a summary of all check plot losses by years. The estimated 1937 losses for each unit and area are given in table 5. The distribution and intensity of these estimated 1937 losses are shown on figure 2. Estimated losses for each area from 1931 to 1937 are given in table 6.

1937 Infestation.—Figure 2 of this report shows the distribution and intensity of the western pine beetle infestation during 1937. On the John Day Area it will be noted that only a normal infestation exists over most of the area, with light epidemic infestation in the pine stands around the lower edge, primarily on the south and west exposures. The infestation is very low on the north half of the Malheur River Area, and on the south portion of this area it increases rapidly with decrease of elevation. On the Callamity and Crow Flat Units of this area are found the heaviest concentrations on the forest. This infestation is of moderate epidemic proportions.

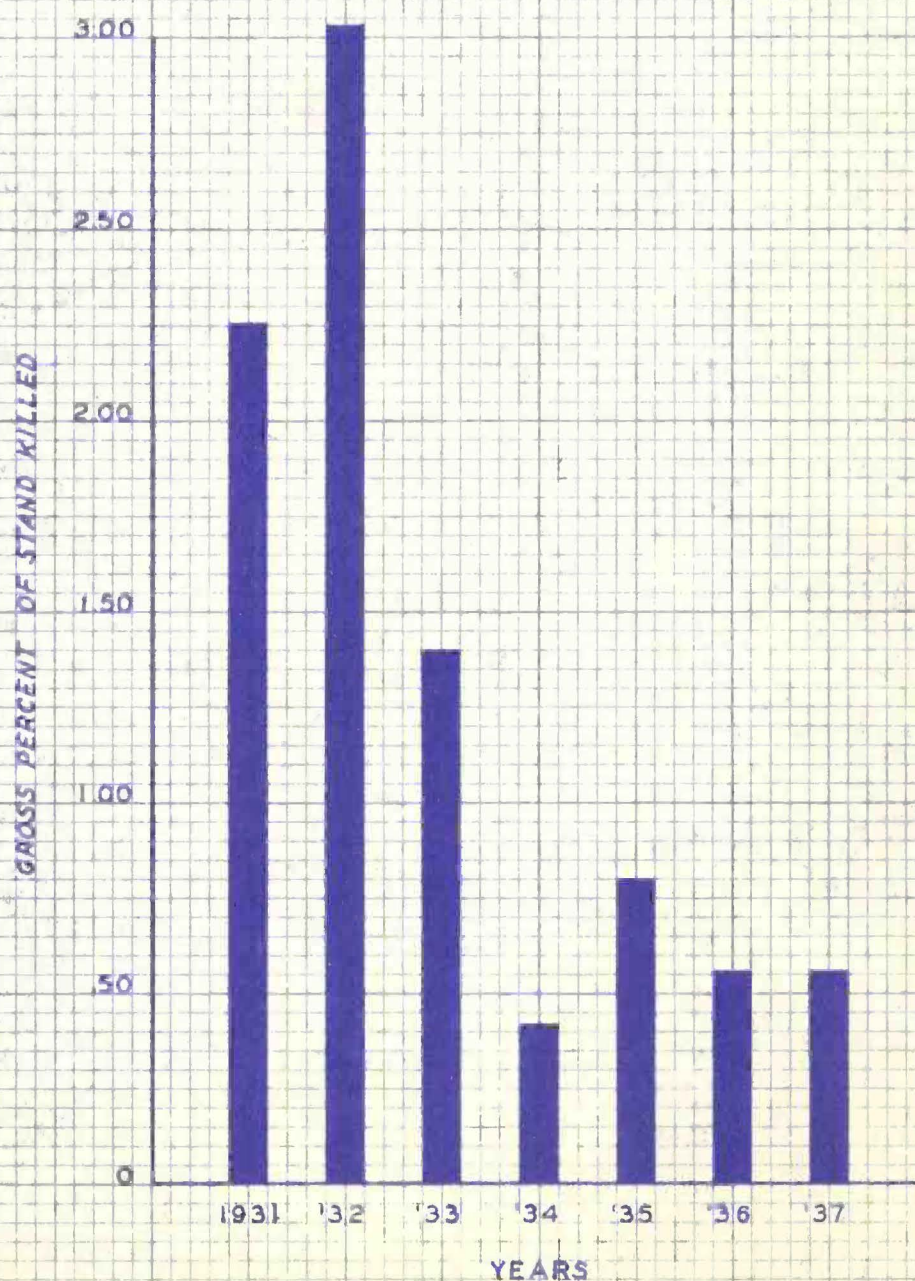
On the Silvies Area a light, bordering on moderate, epidemic infestation extends from the fringe type well back into the better stands. Residual stands on the cut-over lands in the Bear Valley Unit have not recovered as yet from the effects of logging and are supporting a light-to-moderate infestation.

1938 Infestation.—The 1938 survey was conducted from July 26 to August 19, when less than 40 percent of the total 1938 loss had developed. By using an estimating factor based on the date of cruise, an estimate has been made of the probable total loss that

2/ Low Temperatures as a Limiting Factor in Western Pine Beetle Epidemics, 1933.—F. P. Keen and J. A. Beal, U. S. Bureau of Entomology and Plant Quarantine.

CHART NO. 1

TREND OF SAMPLE PLOT LOSSES,
MALHEUR NATIONAL FOREST, OREGON



would occur during 1938. Although these estimates are subject to considerable error when based on cruises made so early in the season, they do give an indication of the probable trend of the infestation. Table 5 gives the estimates and the ratio between the 1938 and 1937 losses for each check plot. These data show the 1938 infestation trend is upward, with a probable increase of 41 percent. The infestation is also of a more aggressive character, with a tendency toward group killings.

Other Insects.

While this report deals primarily with the western pine beetle situation, a word will be added about an outbreak of the Douglas fir tussock moth (Hemerocampa pseudotsugata McD.), discovered in 1937 by Ranger Ward in the stands of white and Douglas firs on the Radio Mountain Unit around Keaney Meadows. It is the first appearance of this pest on this forest since the outbreak which subsided in 1931. The area was visited by the writer on August 31, 1938. The infestation appeared to have increased over that of 1937. Extending northwest from Black Butte, it now covers the length and breadth of the ridge, which is isolated on three sides by open country. The area is approximately 6 to 10 miles wide by 20 miles long. While the infestation extends over the entire area, heavy defoliation occurred only in many of the small canyons on both the white and Douglas firs. At the time of the writer's visit, most of the adults had emerged and numerous egg clusters were in evidence. A dipterous parasite was abundant in the areas of heavy defoliation.

In the fall of 1938, Theodore Kachin and M. C. Welsh of the Forest Experiment Station, while working on thinning experiments in the Burns Ranger District, found an extensive area of ponderosa pine reproduction and saplings seriously affected with a "twig blight", or general stunting and galling of terminal and lateral branches. Sample twigs were examined by F. P. Keen and found to be suffering from a heavy attack of a bark scale of the genus Matsucoccus. This was later identified by Dr. Morrison of the U. S. National Museum as Matsucoccus bisetosus Morr., a species newly described by him in January 1939 ^{2/}. From the character of the injury it was evident that this infestation had been in progress for many years, but until this discovery, had been completely overlooked as being of insect origin.

Summary.

Infestation 1931-36, Inclusive.--Prolonged drought conditions which became critical at the beginning of this decade created adverse growth conditions, resulting in lowered resistance of the pine stands

^{2/} Proc. Ent. Soc. of Wash., Vol. 41, No. 1, p. 3.

and enabling an endemic infestation of the western pine beetle to assume epidemic proportions. This epidemic reached its greatest intensity in 1932, at which time a loss of 5.14 percent of the stand for the season of 1932 was recorded on one sample plot and a loss of 12.34 percent was recorded for the period 1931-33. The breaking up of the epidemic was largely due to two periods of subzero temperatures, -34° and -54° F., during the winter of 1932-33, causing a mortality of 85.3 percent to overwintering broods. Lacking aggressiveness, the infestation rapidly declined to a low point in 1934. Subsequent cold periods and better growth conditions have kept the infestation at a low status during the two-year period 1935-36.

1937 Infestation.—A light epidemic infestation was found in the stands at low to moderate elevations having south or west exposures. Also two small areas of moderate epidemic were found to exist on the Calamity and Crow Flat Units, Malheur River Area. Elsewhere over the forest only a light to normal infestation was found.

1938 Infestation.—The trend is upward, showing an increase of 40 percent over 1937, and of more aggressive nature, with an increasing tendency toward group killings. Probably there is no change in distribution from 1937.

Pussock Moth.—An abundance of host material remains in the area of infestation. It is likely that the defoliation of 1939 will be much greater than that of 1938, unless the parasites prove abundant enough to hold it in check.

Scale.—Severe damage to reproduction in the Crow Flat Unit of the Malheur River Area has been caused by bark gall scales (*Matsucoccus bisetosus*).

Other Reports of Surveys on Malheur National Forest.

"Bark-beetle Survey on Malheur National Forest, Fall of 1933"—
J. M. Whiteside, Assistant Field Aide.

Table 1.--Acreage and Volume of Ponderosa Pine on Infestation Areas on and Adjacent to the Malheur National Forest.

Area	Total Acreage of Ponderosa Pine		Ponderosa Pine Volume as of Jan. 1, 1937	
	Acrea	Percent	cu. ft.	Percent
John Day	361,000	35.5	2,455,643	29.3
Silvies	290,000	28.5	2,272,525	27.1
Malheur River	314,000	30.9	3,322,326	39.7
Snow Mountain	59,000	5.1	325,239	3.9
Totals	1,018,000	100.0	8,374,733	100.0

* U.S.D.A. Pacific Northwest Forest Experiment Station.

Forest Statistics for Grant Co., Oreg., Walter E. Pelton, Aug. 5, 1937.

" " " Harney Co., Oreg., F. L. Moravets, May 7, 1936.

" " " Baker Co., Oreg., W. H. Holles, May 10, 1937.

Corrected for cutting since surveys.

Table 2.—Pine-Beetle Damage on Check Plots on the Malheur National Forest.

Area, Unit and Plot Location	Pine Timbered Acres	Site	Ponderosa Pine Volume in Bd. ft.	Beetle Losses in Ponderosa Pine					
				Year of Attack	Truss Killed	Volume Killed Bd. ft.	% Stand per A.	% Killed	
<u>John Day</u>									
Radio Mountain T.11S, R.28E., Sec. 26N/2	245	4	3,659,510	1937	38	33,090	135	.90	
Long Creek T.10S, R.28E., Sec. 24S/2	320	4	3,008,180	1935	14	15,070	49	.50	
			2,993,110	1936	20	10,700	33	.36	
			2,982,410	1937	20	11,240	35	.37	
Hiyu Unit T.11S, R.32E., Sec. 3S/2	320	4	2,560,760	1937	28	16,570	52	.65	
Beech Creek T.12S, R.31E., Sec.25N/2	313	4	2,763,625	1935	93	64,550	206	2.34	
			2,699,075	1936	85	54,670	175	2.03	
			2,644,405	1937	61	35,080	112	1.35	
<u>Malheur River</u>									
North Fork T.16S, R.35E., Sec. 10N/2	320	4	8,578,180	1937	16	16,840	53	.19	
Summit Creek T.17S, R.35E., Sec.29E/2	320	4	4,468,230	1937	3	4,360	14	.10	
Middle Fork T.17S, R.39E., Sec. 28S/2	320	4	3,902,490	1936	39	28,010	87	.72	
			3,874,480	1937	49	43,640	136	1.13	
Bridge Creek T.16S, R.32E., Sec. 14E/2	320	4+	4,724,195	1935	43	36,300	113	.77	
			4,687,895	1936	28	14,660	46	.31	
			4,673,235	1937	45	24,840	78	.53	

Table 2.—Pine-Beetle Damage on Check Plots on Malheur National Forest (continued)

Area, Unit and Plot Location	Pine Timbered Acres	Site	Ponderosa Pine Volume in Bd.ft.	Beetle Losses in Ponderosa Pine				
				Year of Attack	Trees Killed	Volume Killed Bd. ft.	% Stand per Acre	Killed
<u>Malheur River (cont.)</u>								
Bridge Creek T.17S, R.32E, Sec. 36N/2	320	4	5,142,270 5,119,820	1936 1937	33 41	22,450 33,600	70 105	.44 .66
Crow Flat T.20S, R.32E, Sec.30N/2	320	5	5,533,035	1937	63	41,400	129	.74
<u>Silvies</u>								
Flagtail T.15S, R.29E, Sec. 17SE/4	160	4+	2,451,170 2,425,800 2,345,925 2,291,495	1931 1932 1933 1934	43 114 70 13	25,370 79,575 54,430 12,160	158 499 339 76	1.03 3.28 2.32 .53
T.15S, R.29E, Sec- 17E/2	320		4,558,670 4,514,680 4,485,850	1935 1936 1937	34 35 34	43,990 28,830 44,980	137 90 140	.97 .64 1.00
Flagtail T.16S, R.28E, Sec.26N/2	320	4	5,154,100	1937	29	28,540	89	.55
Myrtle T.17S, R.29E, Sec.26N/4	160	4+	2,430,255 2,413,995 2,390,025 2,382,100	1931 1932 1933 1934	41 46 17 10	16,260 23,970 7,925 4,060	101 150 49 25	.67 .99 .33 .17
T.17S, R.29E, Sec.26E/2	320		4,756,090 4,740,750 4,722,630	1935 1936 1937	20 21 21	15,340 18,120 21,420	48 57 67	.31 .38 .45

Table 2.—Pine-Beetle Damage on Check Plots on Malheur National Forest (continued)

Area, Unit and Plot Location	Pine Timbered Acres	Site	Ponderosa Pine		Beetle Losses in Ponderosa Pine				
			Volume in Bd. ft.		Year of Attack	Volume Killed Bd. ft.	% Stand Killed		
<u>Silvies (cont.)</u>									
Myrtle T.128, R.30E, Sec.11E/2	320	4	7,161,700	1936	49	27,800	87	.39	
			7,133,900	1937	42	25,230	79	.35	
T.128, R.30E, Sec. 32E/2	320	5	3,309,740	1936	13	5,940	18	.18	
			3,303,800	1937	21	14,270	44	.43	
<u>Snow Mountain</u>									
Sawtooth T.198, R.28E, Sec. 15NE/4	160	4	2,963,970	1931	297	149,720	936	5.06	
			2,814,250	1932	322	144,545	903	5.14	
			2,669,705	1933	99	56,995	356	2.14	
			2,612,710	1934	47	19,560	122	.75	
T.198, R.28E, Sec.15E/2	320		5,186,305	1935	67	35,770	112	.69	
			5,150,535	1936	67	34,980	109	.68	
			5,115,555	1937	46	32,060	100	.62	

Table 3.—Summary of Cruising Data on Check Plots
Malheur National Forest

Area	Year of Attack	No. of Plots	Timbered of Acres Cruised	Volume of Stand Bd. ft.	Trees Killed	Volume Killed Bd. ft.	Trees per Section	Bd. ft. per Acre	Percent Stand Killed
John Day	1935	2	633	5,771,805	107	79,620	108	125	1.39
	1936	2	633	5,692,185	105	65,370	106	103	1.17
	1937	4	1198	11,847,085	147	95,980	78	80	.81

(Above figures totals for all plots)

Totals for All Plots									
Malheur River	1931	1	160	1,671,550	76	28,450	304	178	1.70
	1932	1	160	1,631,830	144	39,720	576	248	2.43
	1933	1	160	1,622,395	18	9,435	72	59	.58
	1934	1	160	1,620,195	7	2,200	28	14	.14
	1935	2	640	7,604,195	52	52,910	52	83	.69
	1936	3	960	13,732,655	100	65,120	66	67	.48
	1937	6	1920	32,246,980	217	164,360	72	86	.51

Totals for All Plots

Malheur River	1931	2	320	4,881,430	84	41,630	168	130	.82
	1932	2	320	4,839,800	160	103,845	320	324	2.07
	1933	2	320	4,735,955	87	62,355	174	195	1.27
	1934	2	320	4,673,600	23	16,220	46	51	.34
	1935	2	640	9,314,760	54	59,330	54	92	.62
	1936	4	1280	19,739,220	118	80,240	59	62	.40
	1937	5	1600	24,629,380	147	134,350	58	84	.53

Totals for Continuous Plots

	1931	2	320	4,881,430	84	41,630	168	130	.82
	1932	2	320	4,839,800	160	103,845	320	324	2.07
	1933	2	320	4,735,955	87	62,355	174	195	1.27
	1934	2	320	4,673,600	23	16,220	46	51	.34
	1935	2	640	9,314,760	54	59,330	54	92	.62
	1936	2	640	9,255,430	56	46,950	56	73	.49
	1937	2	640	9,208,480	55	66,400	55	103	.70

Totals for Continuous Plots									
Snow Mountain	1931	1	160	2,963,970	297	149,720	1138	936	5.06
	1932	1	160	2,814,250	322	144,545	1238	903	5.14
	1933	1	160	2,669,705	99	56,995	396	356	2.14
	1934	1	160	2,612,710	47	19,560	138	122	.75
	1935	1	320	5,186,305	67	35,770	134	112	.69
	1936	1	320	5,150,535	67	34,980	134	109	.68
	1937	1	320	5,115,555	46	32,060	92	100	.62

Table 4.—Summary of Cruising Data on All Check Plots
Malheur National Forest

Year	No. of Attack Plots	Timbered of : Acres	Volume of Pine Stand Bbl. ft.	No. of Trees Killed	Volume of Trees Killed Bbl. ft.	Trees Killed Per Sec.	Bbl. ft. Killed	% of Stand Killed
1931	4	640	9,516,945	457	219,800	457	481 343	2.30
1932	4	640	9,285,875	626	288,110	626	460 451	3.10
1933	4	640	9,028,050	204	128,785	204	630 201	1.13
1934	4	640	8,906,500	77	37,980	77	493 59	.43
1935	7	2233	27,877,065	280	227,580	80	810 102	.82
1936	10	3193	44,324,595	390	245,710	78	630 77	.55
1937	16	5038	74,039,000	557	426,750	70	762 85	.57
Total	49	13024	182,978,090	2,591	1,574,715	127	121	.86

Table 5.—Relation of Estimated 1938 Loss to 1937 Loss

Area and Units	1/2 Section	Site	Elevation	Date of Cruise	Trees Killed				Ratio 1938 to 1937
					1937 Loss		1938 Loss		
					Marked	Total	Marked	Estimated	
					1936	1937	1937	Total	1938
<u>John Day</u>									
Rudlo Mtn.	26W/2	4	4,700	8-16	18	38	26	68	1.8
Long Creek	24S/2	4	4,650	8-15	4	20	11	29	1.4
Hiya	38/2	4	3,900	8-19	2	28	14	35	1.2
Beech Creek	25W/2	4	4,500	8-18	16	61	37	92	1.5
Totals					40	147	88	224	1.5
<u>Malheur River</u>									
North Fork	10W/2	4	5,500	8-12	7	16	8	23	1.4
Summit Creek	29E/2	4	5,500	8-11	1	3	5	15	5.0
Middle Fork	28E/2	4	4,000	8-9	14	49	11	34	.7
Bridge Creek	14E/2	4+	5,100	10-1	14	45	36	48	1.1
Bridge Creek	36W/2	4	5,500	8-4	11	41	13	46	1.1
Crow Flat	30W/2	5	6,100	8-5	18	63	26	90	1.4
Totals					65	217	99	256	1.2
<u>Silvies</u>									
Flagtail	17E/2	4+	4,000	11-2	10	34	61	80	2.3
Flagtail	26W/2	4	4,600	7-27	8	29	13	59	2.0
Myrtle	26W/2	4+	5,970	7-28	9	21	2	9	.4
Myrtle	32E/2	5	5,500	7-29	16	42	14	58	1.4
Totals					43	126	90	206	1.6
<u>Snow Mountain</u>									
Sawtooth	15E/2	4	5,500	8-1	3	46	19	73	1.6
Totals for all areas					151	536	396	759	1.41

Table 6.—Estimated Ponderosa Pine Losses for 1937.

Area and Units	Ponderosa Pine Acreage		Volume of Ponderosa Pine		Estimated 1937 Loss		
			Jan. 1, 1937		Bd.ft. per		
	Total	Virgin	Mm.	Trees	Volume Mm.	Acres	Stand
<u>John Day</u>							
Long Creek	~~19,460~~	~~16,220~~	203,169	2,170	1,225	~~30~~	.60
Radio Mtn.	81,680	81,680	547,175	4,470	3,980	49	.73
Hiya	~~17,720~~	~~13,120~~	511,806	1,670	990	~~41~~	.19
Beech Creek	88,680	86,440	655,853	5,580	3,210	36	.49
Fields Peak	25,760	25,760	62,226	850	535	21	.86
(1) Strawberry Mtn.	41,860	38,260	163,780	970	610	15	.37
(2) Canyon Creek	62,880	58,880	309,634	3,770	2,450	39	.79
Area Total	361,000	340,360	2,455,643	19,480	13,000	36	.53
<u>Malheur River</u>							
North Fork	73,880	73,880	944,139	1,700	1,300	18	.14
Summit Creek	32,140	32,140	459,857	700	500	15	.11
Lake Creek	31,500	31,500	318,717	400	300	10	.10
Middle Fork	44,940	42,700	478,259	3,200	2,500	56	.52
Bridge Creek	44,356	40,756	500,693	4,300	2,800	63	.56
Calamity Butte	25,992	23,752	188,734	3,200	2,100	81	1.11
Grow Flat	61,192	48,162	431,927	4,600	3,000	49	.70
Area Total	314,000	295,130	3,322,326	18,100	12,500	40	.38
<u>Silvies</u>							
Flagtail	96,734	96,734	653,054	7,500	5,900	61	.91
(3) Bear Valley	78,513	36,900	681,635	4,700	2,350	30	.35
Myrtle	114,703	113,433	936,831	8,300	6,400	56	.68
Area Total	290,000	247,127	2,271,520	20,500	14,600	50	.69
<u>Snow Mountain</u>							
Sawtooth	53,000	53,000	325,239	4,300	2,500	47	.77

Table 7.—Summary of Estimated Ponderosa Pine Losses by Areas for 1937

John Day	361,000	340,360	2,455,643	19,480	13,000	36	.53
Malheur River	314,000	295,130	3,322,326	18,100	12,500	40	.38
Silvies	290,000	247,127	2,271,525	20,500	14,600	50	.69
Snow Mountain	53,000	53,000	325,239	4,300	2,500	47	.77
Totals	1,018,000	935,617	8,374,733	62,380	42,600	42	.51

- (1) 5,120 acres cut over.
 (2) 3,840 acres cut over.
 (3) Partly cut over—stand as of Jan. 1, 1936.

Table 8.—Estimated Beetle Losses by Infestation Areas, 1931-1937, Inclusive.
Malheur National Forest

Infestation Areas	Total Pine Acreage	Total Pine Volume Mm. as of Jan. 1, '31	Estimated Ponderosa pine losses by years								Total Volume Killed 1931-1937	% of Stand Killed
			Vol. killed Mm. Bd.ft. per A.	1931	1932	1933	1934	1935	1936	1937		
John Day	361,000	2,697,000	Vol. killed Mm. Bd.ft. per A.	33,480 93	33,480 93	19,900 55	36,280 105	27,900 77	27,900 77	13,000 36	191,940 530	7.11
Silvies	290,000	2,495,000	Vol. killed Mm. Bd.ft. per A.	26,500 91	44,000 152	22,000 76	6,500 22	12,000 41	10,000 34	14,000 48	135,000 465	5.41
Malheur River	314,000	3,465,000	Vol. killed Mm. Bd.ft. per A.	24,000 76	48,000 153	24,000 76	7,200 23	16,600 53	10,000 32	12,500 40	142,300 452	4.10
Snow Mountain	53,000	372,000	Vol. killed Mm. Bd.ft. per A.	12,000 226	20,000 377	5,000 94	1,800 34	2,200 41	3,000 57	2,500 47	46,500 878	12.50
Totals for Forest	1,018,000	9,029,000	Vol. killed Mm. Bd.ft. per A.	95,980 95	145,480 144	70,900 70	51,780 51	58,700 58	50,900 50	42,000 42	515,740 510	5.70
Percent of stand killed each year				1.06	1.61	.79	.57	.65	.56	.47		

WESTERN PINE BEETLE SURVEYS
MALHEUR NATIONAL FOREST, OREGON

FIG 2

FOREST TYPE LEGEND

-  PONDEROSA PINE, SMALL (12" TO 22")
-  PONDEROSA PINE, LARGE (22" AND OVER)
-  MIXED PINE AND FIR
-  MIXED TYPE
-  CUT-OVER AREAS

1937 INFESTATION LEGEND

-  NORMAL INFESTATION
-  NORMAL INFESTATION
-  LIGHT EPIDEMIC INFESTATION
-  MODERATE EPIDEMIC INFESTATION
-  HEAVY EPIDEMIC INFESTATION

SCALE 1 INCH = 12 MILES

MAY 1939

